## CLAIMS

We claim:

5      1.   A computer-implemented method for extending a database transaction to include
       at least one user-defined operation that accesses a computer resource by means of an
       XA Transaction Protocol, said method comprising:
            registering said user-defined operation with said database;
            executing said database transaction;
10           enabling said database to operate as an XA Transaction Manager by means of said
       XA Transaction Protocol;
            accessing a resource manager by said database operating as said XA Transaction
       Manager;
            invoking said user-defined operation as part of said database transaction;
15           recording with said database that said user-defined operation has been invoked;
            executing said invoked and recorded user-defined operation while executing said
       database transaction; and
            accessing said computer resource by said resource manager, thereby extending
       said database transaction.

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       2.   The method of Claim 1, wherein said database transaction is a single-phase
            transaction.


       3.   The method of Claim 1, wherein said database transaction is a two-phase commit
25          transaction.


       4.   The method of Claim 1, wherein executing said database transaction comprises an
            application program initiating said database transaction.


30     5.   The method of Claim 1, wherein executing said database transaction comprises a
            transaction manager external to said database initiating said database transaction.

6. The method of Claim 1, wherein said recording is completed with an XA Transaction Protocol Interface.

5     7. The method of Claim 1, wherein said invoking said user-defined operation is completed with a data access module.

8. The method of Claim 1, wherein said resource manager manages a distributed computer resource.

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9. The method of Claim 1, wherein said resource manager manages a local computer resource.

10. A computer system for efficiently extending a database transaction to include at least
15   one user-defined operation that accesses a computer resource by means of an XA Transaction Protocol, comprising:

said user-defined operation that is registered with said database;

said database transaction that is executed, that operates as an XA Transaction Manager by means of said XA Transaction Protocol, and that invokes said user-defined
20 . operation;

a resource manager that is accessed by said database operating as said XA Transaction Manager;

said database that records that said user-defined operation has been invoked; and

said invoked and recorded user-defined operation that is executed while said
25   database transaction is executed; and

said computer resource that is accessed by said resource manager while said database transaction is executed, thereby extending said database transaction.

11. The computer system of Claim 10, wherein said database transaction is a single-
30      phase transaction.

12. The computer system of Claim 10, wherein said database transaction is a two-phase commit transaction.

13. The computer system of Claim 10, wherein said database transaction is initiated by an application program.

14. The computer system of Claim 10, wherein said database transaction is initiated by a transaction manager external to said database.

15. The computer system of Claim 10, wherein said database recording is completed with an XA Transaction Protocol Interface.

16. The computer system of Claim 10, wherein said user-defined operation is invoked with a data access module.

17. The computer system of Claim 10, wherein said resource manager manages a distributed computer resource.

18. The computer system of Claim 10, wherein said resource manager manages a local computer resource.

19. An article of manufacture comprising a computer program usable medium embodying one or more instructions executable by said computer for extending a database transaction to include at least one user-defined operation that accesses a computer resource by means of an XA Transaction Protocol wherein:
said computer usable instructions register said user-defined operation with said database;
said computer usable instructions execute said database transaction;
said computer usable instructions enable said database to operate as an XA Transaction Manager by means of said XA Transaction Protocol;
said computer usable instructions access a resource manager by said database;
said computer usable instructions operate as said XA Transaction Manager;

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said computer usable instructions invoke said user-defined operation as part of said

database transaction;

said computer usable instructions record with said database that said user-defined

operation has been invoked;

5      said computer usable instructions execute said invoked and recorded user-defined

operation while executing said database transaction; and

said computer usable instructions access said computer resource by said resource

manager, thereby extending said database transaction.

10      20. The article of manufacture of Claim 19, wherein said database transaction is a

single-phase transaction.


21. The article of manufacture of Claim 19, wherein said database transaction is a

two-phase commit transaction.

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22. The article of manufacture of Claim 19, wherein said computer usable instructions

initiate said executing database transaction by an application program.


23. The article of manufacture of Claim 19, wherein said computer usable instructions

.20      initiate said executing database transaction by a transaction manager external to

said database.


24. The article of manufacture of Claim 19, wherein said computer usable instructions

complete said database recording with an XA Transaction Protocol Interface.

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25. The article of manufacture of Claim 19, wherein said computer usable instructions

invoke said user-defined operation with a data access module.


26. The article of manufacture of Claim 19, wherein said computer usable instructions

30      manage a distributed computer resource by said resource manager.

27. The article of manufacture of Claim 19, wherein said computer usable instructions manage a local computer resource by said resource manager.

28. A computer data signal embodied in a carrier wave comprising instructions for extending a database transaction to include at least one user-defined operation that accesses a computer resource by means of an XA Transaction Protocol, the computer data signal comprising:

one or more instructions for registering said user-defined operation with said database;

one or more instructions for executing said database transaction;

one or more instructions for enabling said database to operate as an XA Transaction Manager by means of said XA Transaction Protocol;

one or more instructions for accessing a resource manager by said database operating as said XA Transaction Manager;

one or more instructions for invoking said user-defined operation as part of said database transaction;

one or more instructions for recording with said database that said user-defined operation has been invoked;

one or more instructions for executing said invoked and recorded user-defined operation while executing said database transaction; and

one or more instructions for accessing said computer resource by said resource manager, thereby extending said database transaction.

29. The computer data signal embodied in a carrier wave of Claim 28, wherein said database transaction is a two-phase commit transaction.

30. The computer data signal embodied in a carrier wave of Claim 28, further comprising one or more instructions for completing recording of said database with an XA Transaction Protocol Interface.